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ON THE ARRANGEMENT OF THE FAMILIES OF COLEOPTERA.

By G. R. CROTCH, M. A.

(Read before the American Philosophical Society, February 7, 1873.)

Since the publications of Dr. Leconte and C. G. Thomson, the classification of the order Coleoptera has been placed on quite a new footing, and though the old divisions are in great part retained, yet they are defined by entirely fresh characters and are purged of various heterogeneous elements that had been added to them. Thomson has, indeed, developed a singular classification, differing very widely from any in use, hence I have only been able to avail myself of the details; and certainly no other author has shown such minuteness of observation, though unfortunately he has confined himself entirely to the Swedish fauna. It is, however, to Dr. Leconte that we owe the most brilliant and fundamental generalization, namely, his isolation of the *Rhynchophora* by the structure of the prosternum; the remaining groups can then be worked out with comparative ease, though the three divisions into which they naturally fall do not admit of being sharply and definitely characterized. Hence I propose to divide the Coleoptera, as follows:

A. Anterior coxal cavities closed by the junction of the epimera, elytral epipleuræ obsolete, head more or less rostral, tarsi 5 jointed, 3d bilobed, fourth minute..... *Rhynchophora*.

B. Anterior coxæ open, or closed by the epimera meeting the prosternum, epipleuræ generally distinct..... *Coleoptera genuina*.

The only apparent exceptions to this division, are the genus *Cossyphus* pointed out by Dr. Horn, and some of the *Colydiidæ*, as *Bothrideres* and *Deretaphrus*, but none of these have the characteristic tarsi; I know of nothing in the *Tetramerous* series approaching such a structure. The *Coleoptera genuina* may be thus divided:

A. Tarsi 5, 5, 4; antennæ moniliform, filiform, or serrate, not clavate..... *Heteromera*.

B. Tarsi variable, normally 5, 5, 5, antennæ variable. *Isomera*.

The only character to be relied on here is the tarsal joints; and undoubted Heteromerous genera occur in the *Isomera*, especially in the *Clavicornes*, as *Liodes*, etc. The antennæ are clavate in *Pentaphyllus*, *Paratenetus*, and some others; *Tetratoma* also has them strongly clavate and is probably a *Clavicorn*.

ISOMERA.

A. Tarsi with the 3d joint bilobed, or bifid, 4th very minute connate with the last, antennæ moniliform or filiform..... *Tetramera*.

B. Tarsi variable, generally filiform and simple..... *Pentamera*.

The characteristic Tetramerous tarsi recur in *Erotylidæ*, but are accompanied by a well marked antennal club, and securiform palpi; in

Dacne also this structure goes gradually out. It may be noticed also that the tarsal characters are constant in *Rhynchophora*, *Tetramera*, and *Heteromera*, all the variations by a diminished number of joints belonging to the sub-series *Clavicornes*.

PENTAMERA.

- A. Ventral segments 6, 1-3 connate, 1st visible only at the sides. *Adephaga*.
- B. 1st ventral segment visible in the middle.
 - a. Antennæ clavate, anterior coxal cavities variable *Clavicornes*.
 - b. Antennæ lamellate, cavities closed. *Lamellicornes*.
 - c. Antennæ serrate or filiform, cavities open. *Serricornes*.

The natural arrangement would be *Lamellicornes*, *Clavicornes*, *Adephaga*, *Serricornes*.

These groups are fairly exact; the difficulty lies between *Clavicornes* and *Serricornes*, and no clearly dividing line has yet been expressed. I think, however, that the antennæ afford a moderately good character; thus the clavate members of *Anobiidæ* and *Cleridæ* cannot be referred to *Clavicornes* as some of their closest allies are obviously pectinate, but *Cis* and *Bitoma* [*Lyctus*] seem to me undoubted *Clavicornes*.

ADEPHAGA.

- A. Eyes 2, antennæ filiform.
- B. Posterior coxæ separate, anterior coxal cavities closed (except in *Trachypachys* and *Carabini*).
 - C. Antennæ inserted on the front. *Cicindelidæ*.
 - Ca. Antennæ inserted under the front. *Carabidæ*.
- Ba. Posterior coxæ contiguous.
 - C. Anterior coxal cavities closed, posterior coxæ not reaching the margin. *Pseudomorphidæ*.
 - Ca. Cavities open, coxæ reaching the margin.
 - D. Posterior coxæ large transverse. *Amphizoidæ*.
 - Da. Posterior coxæ very large rounded.
 - E. Posterior coxæ forming a plate covering the abdomen. *Halipidæ*.
 - Ea. Posterior coxæ connate with the small metasternum. *Dytiscidæ*.
- Aa. Eyes two, feebly granulated, sometimes wanting; antennæ moniliform.
 - Posterior coxæ small, sub-triangular, prominent, distant. *Rhyssodidæ*.
- Ab. Eyes four, antennæ short, stout.
 - Anterior coxæ globular. *Gyrinidæ*.

Whether the first six families would not properly be considered sub-families of Adephaga, is to me doubtful; the dividing lines break down at many points, *e. g.*, *Elaphrus* is practically a *Cicindelid*, and *Pelobius* is

a natatorial Amphizoid. This latter is in fact most anomalous; the suture of the 2d ventral segment is obliterated in the middle so that it appears to be visible at the sides only; the posterior coxæ are quite, as in *Amphizoa*, without any trace of the large plates of the *Dytiscidæ*, the metasternum also has the transverse suture behind which is always visible in *Carabidæ*, never in *Dytiscidæ*. It will have either to be made into yet another family or will merge the others into one large family modified for terrestrial and aquatic life.

RHYSSODIDÆ.

Anterior coxæ small, globular, prominent, cavities closed.

Posterior coxæ small, sub-triangular, prominent, separate.

Ventral segments 6, 1st visible at the side and in the middle, 2-4 connate.

Tarsi 5-jointed, simple.

This anomalous family must be ranged in the Adelphagous series as here defined, from all members of which it is at once known by the curious posterior coxæ. The antennæ are moniliform and resemble those of *Scaritidæ*, to which group it is evidently allied, though it cannot be denied that it has strong apparent affinities with *Cucujidæ*. These, however, are not stronger than its analogy to *Brenthus* and depend on a similar mode of life. The 2d ventral segment (the first is obsolete) visible at the sides and middle only, and the distinct side pieces of the thorax are characters possessed by no other Coleopterous insect out of this series. It may here be noticed that the 2d ventral segment in *Carabidæ* is often visible in the middle at the point of the ventral process, especially in *Brachynus*.

CLAVICORNES. Latr.

This large and somewhat heterogeneous group is principally characterized by the clavate or capitate antennæ; very few species being moniliform (*Cucujus*, *Rhyssodes*) and some filiform (*Staphylinidæ*). The form of the anterior coxæ will divide them into groups, according as they are conical and prominent, transverse, or small and globose; the cavities are variable, but open in the major part of the series, closed entirely in the following families, *Rhyssodidæ*, *Latridiidæ*, *Cicidæ*, *Rhizophagidæ*, *Derodontidæ*, and in almost all the genera of *Coccinellidæ*, *Colydiidæ*, *Erotylidæ*. The antennæ never show signs of being serrate, which removes the *Cleridæ* and *Anobiidæ* from the group, though some of their genera have distinctly clubbed antennæ. The number of tarsal joints is also very variable (but all with filiform tarsi 4, 4, 4, and any with a less number of joints belong here), the claws are simple except in *Coccinellidæ*, *Phalacridæ* and some *Nitidulidæ*. The accompanying table will serve to differentiate the families, and a few exceptional cases are noticed in the diagnoses of the families. This table though considerably modified, is entirely based on the admirable one given by Leconte in his classification.

CLAVICORNES.

1. Labial palpi distant at base, anterior coxæ prominent,
often contiguous, claws generally dentate.....
Antennæ 6-9 jointed.

— Labial palpi approximate at base.....	3
2. Maxillary palpi elongate; sub-aquatic.....	<i>Hydrophilidæ.</i>
— Anterior angles of thorax produced under the head in front.....	<i>Leptinidæ.</i>
3. Anterior coxæ conical, prominent, contiguous, cavities generally open.	
Claws simple, ventral segments 6-7 (rarely 5).....	4
— Anterior coxæ ovate or globose, not prominent, very rarely contiguous, ventral segments 5, claws simple.	13
— Anterior coxæ transverse, separated, claws sometimes dentate, 2 ventral segments often connate.....	24
4. Ventral segments 3, globose.....	<i>Microsporidæ.</i>
Ventral segments, 5-6.....	6
Ventral segments, 7.....	5
5. Elytra covering or nearly covering the abdomen....	<i>Trichopterygidæ.</i>
Elytra short, dorsal segments corneous.....	<i>Staphylinidæ.</i>
6. Elytra short, dorsal segments corneous, rigid.....	<i>Pselaphidæ.</i>
Elytra long, 2 or 3 dorsal segments at most corneous.	7
7. Posterior coxæ contiguous.....	8
Posterior coxæ separate.....	9
8. Middle coxæ oblique, simple.....	<i>Silphidæ.</i>
Middle coxæ conical prominent.....	<i>Brathinidæ.</i>
9. Tarsi 4-jointed, 3d joint minute.....	10
Tarsi 4-jointed, filiform.....	<i>Tritomidæ.</i>
Tarsi 5-jointed.....	11
10. Wings fimbriate, size very small.....	<i>Corylophidæ.</i>
1st ventral segment elongate.....	<i>Endomychidæ.</i>
11. Hind coxæ flat.....	12
Hind coxæ sulcate, sub-contiguous.....	<i>Dermestidæ.</i>
12. Elytra entire, eyes coarsely granulate.....	<i>Scydmanidæ.</i>
Elytra truncate, 3 dorsal segments corneous.....	<i>Scaphidiidæ.</i>
13.	
13. Hind coxæ sulcate, front with an ocellus.....	<i>Dermestidæ.</i>
Hind coxæ sulcate, front cavities closed.....	<i>Derodontidæ</i>
Hind coxæ flat or sub-prominent.....	14
14. Ventral segments free.....	15
Ventral segments 1-3 connate.....	22
15. Tarsi 3-jointed, anterior cavities closed.....	<i>Latridiidæ.</i>
Tarsi 4-jointed.....	16
Tarsi 5-jointed or 5, 5, 4.....	17
16. Tarsi filiform, cavities open, ventral segments equal	<i>Tritomidæ.</i>
— Tarsi simple, cavities closed, 1st ventral segment longer.....	<i>Cioidæ.</i>
— Tarsi bilobed, cavities open, 1st segment longer....	<i>Endomychidæ.</i>
17. Claws simple.....	18
Claws dentate, 4th joint of tarsi small.....	<i>Phalacridæ.</i>

- | | | |
|--|------------------------|----|
| 18. Antennæ 10-jointed, cavities closed..... | <i>Rhizophagidæ.</i> | |
| Antennæ 11-jointed..... | | 19 |
| 19. Tarsi deeply bilobed, maxillary palpi securiform.... | <i>Erotylidæ.</i> | |
| Tarsi lobed beneath, 4th joint smaller..... | <i>Telmatophilidæ.</i> | |
| Tarsi simple..... | | 20 |
| 20. Antennæ moniliform, segments equal..... | <i>Cucujidæ.</i> | |
| Antennæ clavate, 1st segment elongate..... | | 21 |
| 21. Anterior coxal cavities open..... | <i>Atomariidæ.</i> | |
| Anterior cavities closed..... | <i>Bitomidæ.</i> | |
| 22. Tarsi 4-jointed..... | <i>Colydiidæ.</i> | |
| Tarsi 5-jointed, coxæ all distant..... | <i>Elmidæ.</i> | |
| 24. | | |
| 24. Ventral segments 1-3 connate..... | | 25 |
| Ventral segments free..... | | 28 |
| 25. Hind coxæ sub-contiguous..... | | 26 |
| Hind coxæ separated..... | <i>Elmidæ.</i> | |
| 26. Tarsi 4-jointed, legs fossorial..... | <i>Heteroceridæ.</i> | |
| Tarsi 5-jointed, hind coxæ sulcate..... | | 27 |
| 27. Ventral segments 6-7, antennæ filiform..... | <i>Psephenidæ.</i> | |
| Ventral segments 5, legs retractile..... | <i>Cistelidæ.</i> | |
| Ventral segments 5, antennæ irregular..... | <i>Parnidæ.</i> | |
| 28. Tarsi 3-jointed, elytra short, truncate..... | <i>Micropeplidæ.</i> | |
| Tarsi 4-jointed, antennæ 9-jointed..... | <i>Georyssidæ.</i> | |
| Tarsi 4-jointed, claws dentate..... | <i>Coccinellidæ.</i> | |
| Tarsi 5-jointed, antennæ 10-jointed..... | <i>Rhizophagidæ.</i> | |
| Tarsi 5-jointed, antennæ 11-jointed..... | | 29 |
| 29. Hind coxæ sub-quadrate, not reaching the margin,
elytra truncate, 2 dorsal segments corneous..... | <i>Histeridæ.</i> | |
| Hind coxæ transverse reaching the margin..... | | 30 |
| 30. Tarsi generally dilated, 4th joint small..... | <i>Nitidulidæ.</i> | |
| Tarsi simple, 1st joint short..... | <i>Trogositidæ.</i> | |

The family *Othniidæ* is referred as a distinct family to the Heteramera near *Lagriidæ*.

HYDROPHILIDÆ.

Anterior coxæ prominent, conical, sub-contiguous, cavities open or closed.

Posterior coxæ flat, nearly contiguous, reaching the margin.

Ventral segments 5 (occasionally 7).

Tarsi 5-jointed, posterior legs often fimbriate, claws generally dilate at base. Evidently allied to *Silphidæ* by the coxæ and increased number of segments in some species; the mentum is large, quadrate, labial palpi distant at base, maxillary palpi elongate; antennæ 6-9 jointed, side pieces of mesosternum not divided.

LEPTINIDÆ.

Anterior coxæ oval, not prominent, cavities open, no trochantin.

Posterior coxæ flat.

Ventral segments 6.

Tarsi 5-jointed, 4th oblique beneath, with a brush of hairs.

This family was founded by Dr. Leconte in the Proceedings of the Academy of Natural Sciences for 1866, and is very evidently distinct. The anterior angles of the thorax projecting under the head separate it superficially from all other Coleoptera; the regular antennæ and not prominent coxæ separate it from *Hydrophilidæ*, to which it is allied by the mentum being large and peculiar.

PLATYPSYLLIDÆ.

This extremely anomalous insect has been formed into a separate family near *Leptinus* by Dr. Leconte.

SPHÆRIIDÆ.

Anterior coxæ prominent exserted, contiguous, cavities open.

Posterior coxæ large, laminate, contiguous.

Ventral segments 3.

Tarsi 3-jointed.

Wings ciliate as in *Trichopteryx*, but remarkably distinct by the 3 ventral segments and facies. This family is sub-aquatic in habits, and recalls *Chetarthria* in facies.

TRICHOPTERYGIDÆ.

Anterior coxæ prominent, contiguous, cavities open or closed.

Posterior coxæ transverse, separate.

Ventral segment 6-7.

Tarsi 3-jointed.

Wings fringed with ciliæ. This family contains the smallest known Coleoptera, and is fairly uniform; the most remarkable form is *Limulodes*. Mr. Matthews in his wonderful monograph has shown as I think conclusively, that this family comes in between *Hydrophilidæ* and *Staphylinidæ*, with an additional alliance in *Leptinus*.

STAPHYLINIDÆ.

Anterior coxæ prominent, contiguous, cavities open (except some *Piestidæ*).

Posterior coxæ contiguous.

Ventral segments 7-8, dorsal segments corneous, flexible.

Tarsi variable.

This large family is rendered tolerably homogeneous by the removal of *Micropeplus*, still the *Piestidæ* with an entirely corneous prosternum and globose anterior coxæ seem to me to be anomalous, and approach rather closely to the *Cucujidæ*, but I have not had the opportunity of studying *Ino* or *Hemipeplus*.

PSELAPHIDÆ.

Anterior coxæ conical, prominent, contiguous, cavities open.

Posterior coxæ usually separate.

Ventral segments 5-6, dorsal segments corneous.

Tarsi 3-jointed, claws often unequal or single.

Elytra truncate, palpi often largely developed. This family is very unmistakeable, and is evidently a very degraded form. Eyes coarsely granulated or wanting.

SILPHIDÆ.

Anterior coxæ conical, prominent, contiguous, cavities usually open.

Posterior coxæ transverse contiguous.

Ventral segments 6.

Tarsi variable.

This family appears to me probably composite; but I have not yet been able to differentiate all its sub-divisions. *Sphærites* has only 5 ventral segments, with truncate elytra. *Leptodirus* cannot remain here, with distant posterior coxæ; *Catops* has the anterior coxal cavities more or less closed; *Anisitoma* also has the cavities closed, though the epimera are not united to the prosternum. *Clambus* is probably a family, and also *Leptodirus*. It differs from the other families with contiguous coxæ by the presence of a trochanter.

BRATHINIDÆ.

Anterior coxæ large, conical, prominent contiguous, cavities closed.

Middle coxæ also conical, prominent, contiguous.

Posterior coxæ transverse prominent, contiguous.

Ventral segments 6.

Tarsi 5-jointed, simple.

Form of *Scydmanus* but differing by the middle and posterior coxæ, and evidently forming a distinct family.

SCYDMENIDÆ.

Anterior coxæ conical, prominent contiguous, cavities open.

Posterior coxæ conical, distant.

Ventral segments 6.

Tarsi 5-jointed.

Eyes coarsely granulated. This family has a well defined facies.

CORYLOPHIDÆ.

Anterior coxæ ovate prominent, contiguous, cavities open, no trochanter.

Posterior coxæ distant.

Ventral segments 6.

Tarsi 4-jointed, and 3d very minute.

Wings fimbriate as in *Trichopteryx*, thorax generally produced over the head, elytra sometimes truncate behind. United by Erichson with *Coccinella*, from which it differs by the coxæ and simple claws.

SCAPHIDIDÆ.

Anterior coxæ large, prominent contiguous, cavities open.

Posterior coxæ distant.

Ventral segments 6.

Tarsi 5-jointed, filiform.

Elytra truncate, 3 or 4 dorsal segments corneous; 5th ventral segment large. A small well defined family.

LATRIDIIDÆ.

Anterior coxæ conical, prominent separate, cavities closed.

Ventral segments 5, free, sub-equal.

Tarsi 3-jointed, simple, tibiæ without spurs.

Allied apparently to *Silphidæ* by the anterior coxæ ; separable from its allies by the 3-jointed tarsi.

DERODONTIDÆ.

Anterior coxæ conical, prominent, sub-transverse, contiguous, cavities closed.

Posterior coxæ transverse, dilated internally, protecting the thigh.

Ventral segments 5, free, equal.

Tarsi 5-jointed, 4th is somewhat smaller.

Eyes finely granulated.

Separated by Leconte from *Latridiidæ* with obvious propriety. I have provisionally placed the anomalous genus *Peltastica* in this family, it agrees in all essential characters, and it differs only in facies. The European genus *Phlæophilus* belongs here also, but has the coxal cavities open.

DERMESTIDÆ.

Anterior coxæ conical, prominent, cavities open.

Posterior coxæ transverse, dilated internally to protect the thighs.

Ventral segments 5, free, equal.

Tarsi 5-jointed, tibiæ with spurs.

Front usually with an ocellus.

This family (excluding *Tricagus*) is very homogeneous ; the prominent coxæ and free ventral segments show that it must come near *Silphidæ* ; the majority of genera are at once known by the frontal ocellus.

ENDOMYCHIDÆ.

Anterior coxæ globose, or conical, sometimes contiguous, more or less prominent, cavities open.

Ventral segments 5, first very long.

Tarsi 4-jointed, 2d emarginate, 3d hidden.

Differs from *Mycetophagidæ* by the bilobed tarsi and the long 1st ventral segment. Gerstaecker and Thomson rightly include *Mycetæa* in this family, though the tarsi simulate closely those of *Mycetophagidæ* ; the contiguous sub-conical coxæ show that its place is at this end of the series.

TRIPHYLLIDÆ.

Anterior coxæ oval, prominent, cavities open.

Ventral segments 5, equal.

Tarsi 4-jointed (♂ 3, 4, 4), filiform.

Eyes coarsely granulated.

Leconte has included *Diphyllus*, which I have removed to a separate family. Thomson adds *Tetratoma*, in which I think he is very possibly right ; certainly I do not see that genus belongs to the Heteromerous

series. Geoffroy's name *Tritoma* must be restored to the typical genus *Mycetophagus*, hence I have altered the family name.

CIOIDÆ.

Anterior coxæ oval, not prominent, cavities closed.

Ventral segments 5, 1st elongate.

Tarsi 4-jointed, spurs not distinct.

Antennæ 8-10-jointed.

This family cannot belong in the *Serricornes*, which all have the coxal cavities open; it appears to me to form a distinct family near *Cryptophagidæ* and *Mycetophagidæ*, and this view is confirmed by the larvæ. It differs from the *Bostrychidæ* by the coarsely granulated eyes and distinct epipleuræ continuous to the apex of the elytra. *Endecatomus* as remarked by Leconte is an ordinary *Bostrychid*.

EROTYLIDÆ.

Anterior coxæ globose, separate, cavities generally closed.

Posterior coxæ transverse, not reaching the margin.

Ventral segments 5, 1st elongate.

Tarsi 5-jointed, 3d emarginate above for the 4th, which is very minute.

The coxal cavities are open in *Languria* which otherwise accords. The 4th joint of the tarsi becomes less minute in *Dacne* and *Combocerus*.

It is evident that this family must come near *Cryptophagidæ* where Thomson and Bedel place it. It has no sort of affinity with *Chrysomelidæ*. The strongly securiform maxillary palpi render most of the genera very distinct.

ATOMARIIDÆ.

Anterior coxæ small, globose, or oval, separate, cavities variable.

Ventral segments 5, equal, or with the 1st longer.

Tarsi 5-jointed (♂ sometimes 5, 5, 4), tibiæ with small spurs.

In this family I have included numerous apparently discordant elements, but which I have entirely failed to separate into distinct families. The tarsi are generally linear, lobed beneath in *Telmatophilus*, 4th joint smaller in *Silvanus*, *Psammæcus*, *Biphyllus*, etc.; the antennæ are 11-jointed and moniliform in *Cucujus*, generally with 3-jointed club in the rest. The basal joint of the tarsi is very short in *Cucujus*, long however in *Scalidia* and most others. The length of the ventral segments is also entirely uncertain. *Cucujus* shows an evident affinity to *Trogosita* as seen already by Thomson.

MONOTOMIDÆ.

Anterior coxæ small, rounded, separate, cavities closed.

Ventral segments 5; 1 and 5 elongate.

Tarsi 5-jointed, 4th narrower, 5th elongate.

Elytra truncate, last dorsal segment visible, eyes strongly granulated, antennæ 10-jointed, club abrupt.

This family was founded by Leconte, and as I think, with reason. The structure of the antennæ, the 6th dorsal segment in the ♂ and the facies

all show great affinity to *Rhizophagus*, from which the anterior coxæ at once separate it. Thomson has placed them in *Latridiidae*, which the 5-jointed tarsi prevent; Duval with the *Cucujidae* on account of the short 1st joint of the tarsi. The raised line on the 1st ventral segment and the structure of the head show a close affinity to *Silvanus*.

BITOMIDÆ.

Anterior coxæ rounded, cavities closed.

Ventral segments 5, 1st elongate.

Tarsi 5-jointed, 1st joint extremely minute.

This family was formed by Duval, who included *Endecatomus*, which is however a true *Bostrychide* as shown by Leconte; Thomson has left *Lyctus* also in *Bostrychidae*, but it agrees in all essentials with *Colydiidae* and *Cucujidae*, having a close affinity to the latter by the short 1st joint of the tarsi. The name *Lyctus* was first used for this genus by Latreille in 1807, but Herbst had previously indicated it and in the name *Bitoma* in 1794. Wollaston dissected this genus carefully in 1854, and considered it a *Colydiid*, regarding the basal articulation as merely a swelling; it appears to me certainly very close to *Colydiidae* by the structure of the prosternum, the club, and the obsolete elytra epipleuræ, but the basal joint is visible in some species.

COLYDIIDÆ.

Anterior coxæ small, globular, cavities generally closed.

Posterior coxæ sometimes contiguous, transverse.

Ventral segments 5, 1-3 or 1-4 connate; 1st often elongate.

Tarsi 4-jointed, simple.

Antennæ often capitate, form cylindrical, or depressed and with gradually clavate antennæ. Eyes coarsely granulated. The prosternal structure in *Bothrideres* resemble that of *Brenthus* and also of *Rhyssodes*. *Myrmecoxenus* must be placed here according to Thomson, having the 4-jointed tarsi and connate segments, but he also adds *Silvanus*, in which I cannot concur. He breaks the family up into three, *Bothrideridae*, *Colydiidae*, *Synchitidae*. *Murmidi* if not a separate family can only go here; the globose anterior coxæ and 4th-jointed tarsi would seem to agree very well. After examining *Discoloma* and other genera, it is evident that *Cossyphus* can only go here (or in a separate family next to it, characterized by the heteromerous tarsi).

RHIZOPHAGIDÆ.

Anterior coxæ ovate or rounded, cavities generally transverse, always closed.

Posterior coxæ transverse.

Ventral segments 5, 1st elongate, often with coxal lines.

Tarsi 5-jointed, often dilated.

Antennæ 10-jointed, 11th joint connate with the preceding.

This family is identical with *Monotomidae*, etc., except that I have added

Rhizophagus; it thus makes a very natural family with a distinct facies, and identical structure. The coxal cavities vary from transverse to rounded by imperceptible degrees.

TROGOSITIDÆ.

Anterior coxæ transverse, separate, cavities variable.

Posterior coxæ transverse reaching the margin.

Ventral segments 5, equal.

Tarsi 5-jointed, not dilated.

Peltastica, placed provisionally here by Leconte, I have removed to *Dero-dontidæ*. This family contains two very different types; the elongate narrow *Trogosita* placed by Thomson near *Cucujus* on account of the very minute 1st tarsal joint and less transverse cavities; and the broad species of *Ostoma* (*Peltis*) which are like *Nitidula*, except that the tarsi are not dilated.

NITIDULIDÆ.

Anterior coxæ transverse, cavities generally closed.

Posterior coxæ distant, almost reaching the margin.

Ventral segments 5.

Tarsi 5-jointed, dilated, 4th joint small, claws sometimes dentate.

The capitate antennæ are generally characteristic of this group; the coxal cavities are open in *Cychramus*, *Ips.*, etc.; *Byturus* is better here by the dentate claws than in *Dermestidæ*, though the lobed tarsi are distinctly anomalous; Kiesenwetter and Thomson place it here; Duval places it with *Telmatophilus*, which seems impossible. *Rhizophagus* is excluded by Murray, but is osculant between this family and *Trogositidæ*. The small genera *Hesperobænus*, *Bactridium*, *Europs* and *Nomophlæus* must come here as the cavities are made precise, as in *Rhizophagus*; *Phyconomus* also has dilated tarsi.

MICROPEPLIDÆ.

Anterior coxæ transverse, cavities closed.

Posterior coxæ distant, rounded.

Ventral segments 6.

Tarsi 3-jointed.

Antennæ 9-jointed, with an abrupt club, received into thoracic cavities.

Elytra truncate, short.

This family is very anomalous, but its whole relationship is with *Nitidulidæ*, having no character in common with *Staphylinidæ* except the short elytra. The discovery of the larva also confirms this view.

PHALACRIDÆ.

Anterior coxæ small, globose, separate, cavities open.

Posterior coxæ contiguous, not reaching the margin.

Tarsi 5-jointed, 4th very small, claws dentate.

Allied to *Nitidulidæ* by the claws and tarsi, but differing by the anterior and posterior coxæ, it must, however, evidently be placed next them.

COCCINELLIDÆ.

Anterior coxæ transverse, cavities generally closed.

Posterior coxæ distant, not reaching the margin, sometimes sulcate.

Ventral segments 5-6 (7 in *Hyperaspis* ♂).

Tarsi 4-jointed, 2d bilobed, 3d very minute, claws generally dentate.

The structure of the tarsi has generally caused these insects to be placed at the end of the order, but they evidently belong in the *Clavicorn* series, from all other families of which they differ by their tarsi, combined with securiform palpi, generally dentate claws and usually closed cavities. The only other family with similar tarsi is the *Endomychidæ*, which has small globose anterior coxæ, with open cavities and simple claws. It is, however, to be noticed that the elongate aberrant *Coccidula* has sub-globose anterior coxæ. The coxæ are often sulcate as in *Cistelidæ*.

CISTELIDÆ.

Anterior coxæ transverse, cavities open.

Posterior coxæ sub-contiguous, reaching the margin.

Ventral segments 5, 1-3 sub-connate.

Tarsi 5-jointed, often lobed beneath.

Antennæ gradually clavate, legs retractile, hind coxæ sulcate.

This family is very distinct by its facies. *Chelonarium* may form a separate family, the antennæ are entirely filiform. I have reverted here, as elsewhere, to Geoffroy's name for the typical genus (1762); the name *Byrrhus* belongs to the *Anobium*, Fabr., and the *Byrrhus* of Linnæus is *Anthrenus*, Geoff. By means of *Limnichus* this family is closely allied to *Georyssus* and *Elmis*.

GEORYSSIDÆ.

Anterior coxæ compressed, trochanters large, covering the prosternum, cavities open.

Posterior coxæ distant.

Ventral segments 5, 1st very large, 1-2 connate.

Tarsi 4-jointed, antennæ 9-jointed.

Allied to *Cistelidæ* (*Byrrhidæ*) by the general habit; distinct.

PSEPHENIDÆ.

Anterior coxæ globular, cavities open, prolonged externally, trochanter very large.

Posterior coxæ dilated into a plate, contiguous.

Ventral segments 6-7, 1-2 connate.

Tarsi 5-jointed.

Maxillary palpi very long, securiform, antennæ long, filiform. This insect is most singular and anomalous; notwithstanding the evident affinity to *Parnidæ* it differs remarkably from it by the elongate palpi and 6 ventral segments. The 7th ventral segment is visible only in the ♂. It is in many respects closely allied to *Helodes* in the *Serricornes*. This family is the commencement of a small group of closely allied families, differing in the details of the coxæ, but agreeing remarkably in the parts of the mouth.

PARNIDÆ.

Anterior coxæ transverse, cavities open, trochanter distinct.

Posterior coxæ dilated into a plate, contiguous.

Ventral segments 5, 1-3 connate.

Tarsi 5-jointed.

Antennæ short irregular, as in the *Gyrinidæ*, to which this family is evidently allied, though differing remarkably in the form of the coxæ. Leconte's two sub-families entirely destroy the homogeneity of this family and are made into separate families.

ELMIDÆ.

Anterior coxæ small, rounded, without trochanter, cavities open.

Posterior coxæ transverse, distant.

Ventral segments 5, 1-3 connate.

Tarsi 5-jointed, 5th elongate.

Allied to *Parnidæ* by mode of life, and more or less by the appearance of the larvæ; but remarkably distinct structurally. Antennæ short, hardly sub-clavate. The tarsal structure is very like *Hydrochus* but the broadly distant coxæ entirely remove it.

HETEROCERIDÆ.

Anterior coxæ transverse, cavities open.

Posterior coxæ sub-contiguous.

Ventral segments 5, 1-3 connate.

Tarsi 4-jointed.

Antennæ 10-11-jointed short, irregular. Evidently allied to *Parnidæ*, but with a very characteristic facies.

HISTERIDÆ.

Anterior coxæ transverse, cavities open.

Posterior coxæ distant, sub-quadrate, not reaching the margins.

Ventral segments 5, 1st very large.

Tarsi 5-jointed (*Acritus* 5, 5, 4), legs retractile.

Differs from the other families by the geniculate antennæ, with a compact rounded club; elytra truncate, 2 dorsal segments uncovered, corneous. *Murmidius*, placed here by Dr. Leconte, seems to me certainly an aberrant form of *Colydiidæ*.

The two families of *Lamellicornes* are easily distinguished. The *Serri-corn* series also is well arranged by Leconte. The *Tetramera* include only 3 families, *Cerambycidæ*, *Bruchidæ*, *Chrysomelidæ*, and their limits are hard to define. The *Heteromera* have been divided by Leconte into convenient families; possibly *Lagriæ* and *Allecula* (*Cistela*) should go in *Tenebrionidæ* and certainly *Nilio* should go with *Pythidæ*, bearing as Dr. Horn has suggested to me, the same relation to it as *Thymalus* does to *Trogositidæ*. The *Rhynchophorus* families are still doubtful, probably there are only three, *Anthribidæ*, *Curculionidæ* and *Scolytidæ*.